

MICROELECTRONICS AND RELIABILITY

An International Journal & World Abstracting Service

Volume 31, 1991

Editor-in-Chief

G. W. A. DUMMER
(Malvern Wells)

Assistant Editor-in-Chief

H. REICHE
(Ottawa)



PERGAMON PRESS

OXFORD · NEW YORK · SEOUL · TOKYO

MICROELECTRONICS AND RELIABILITY

EDITOR-IN-CHIEF

G. W. A. DUMMER, 27 King Edwards Road, Malvern Wells, Worcs. WR14 4AJ, U.K.

ASSISTANT EDITOR-IN-CHIEF

H. REICHE, 22 Chapleau Avenue, Ottawa, Ontario, Canada

EDITORS

W. D. BROWN, Dept. of Electrical Engineering, College of Engineering, University of Arkansas, 3217 Bell Engineering Center, Fayetteville, AR 72701, U.S.A.

P. DIETRICH, Schillerstrasse 3, D-6101 Robdorf 1, F.R.G.

R. M. JACOBS, Consultant Services Institutes Inc., 651 West Mount Pleasant Avenue, Livingston, NJ 07039, U.S.A.

H. A. KEMHADJIAN, Dept. of Electronics, University of Southampton, Southampton SO9 5NH, U.K.

K. B. MISRA, Reliability Engineering Centre, Indian Institute of Technology, Kharagpur-721302, W.B., India.
(contributors from India should refer to the Notes for Contributors on the inside back cover)

F. POPENTIU, Association of Scientists in Romania, P.O. Box 22-162, Bucharest, Romania.

A. H. RAWICZ, School of Engineering Science, Simon Fraser University, Burnaby, B.C., Canada V5A 1S6.

C. M. RYERSON, 1402 Acacia Avenue, Torrance, CA 90501, U.S.A.

N. STOJADINOVIC, Faculty of Electronic Engineering, Department of Microelectronics, University of Nis, Beogradskia 14, 1800 Nis, Yugoslavia.

J. F. VERWEY, Twente University, Faculty of Electrical Engineering, P.O. Box 217, NL-7500 AE Enschede, The Netherlands.

ADVISORY EDITORS

A. P. AMBLER, Uxbridge, Middx., U.K.

R. P. ANJARD, Sr, San Diego, California, U.S.A.

R. BILLINTON, Saskatoon, Canada.

H. S. BLANKS, Bondi, N.S.W., Australia.

J. BOREL, Grenoble, France.

D. S. CAMPBELL, Loughborough, Leics., U.K.

J. C. CLUELY, Birmingham, U.K.

B. S. DHILLON, Ontario, Canada.

P. J. EVISON, Isle of Wight, U.K.

E. FINARDI, Milan, Italy.

R. GOARIN, Lannion, France.

G. S. HURA, Dayton, Ohio, U.S.A.

N. KOVALEV, Moscow, U.S.S.R.

H. G. MANFIELD, Malvern, Worcestershire, U.K.

G. U. MATTANA, Milan, Italy.

G. V. PLANER, Sunbury-on-Thames, Middx., U.K.

YOSHIIRO SAITO, Tokyo, Japan.

C. P. SANDBANK, Harlow, Essex, U.K.

A. A. SHEPHERD, Wythenshawe, Manchester, U.K.

HIROSHI SHIOMI, Tokyo, Japan.

C. SINGH, College Station, Texas, U.S.A.

YASUO TARUI, Tokyo, Japan.

TWELVE ISSUES PUBLISHED PER ANNUM (FROM VOLUME 32, 1992)

Publishing, Subscription and Advertising Offices:

Headington Hill Hall, Oxford, OX3 0BW (Tel: (0865) 794141; Fax: (0865) 60285)

Annual subscription rates 1992

Annual institutional subscription rate (1992): £585.00 (U.S.\$935.00). Two-year institutional rate (1992/93): £1111.50 (U.S.\$1776.50). Sterling prices are definitive. U.S. dollar prices are quoted for convenience only, and are subject to exchange rate fluctuation. Prices include postage and insurance and are subject to change without notice. Subscription rates for Japan are available on request. Subscription enquiries from customers in North America should be sent to: Pergamon Press Inc., 395 Saw Mill River Road, Elmsford, NY 10523, U.S.A., and for the remainder of the world to: Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, U.K. Tel: (0865) 794141; Fax: (0865) 60285.

Microform and back issues

Back issues of all previously published volumes, in both hard copy and on microform, are available direct from Pergamon Press offices.

Copyright © 1991 Pergamon Press plc

It is a condition of publication that manuscripts submitted to this journal have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from the copyright holder.

U.S. Copyright Law Applicable to Users in the U.S.A.

Photocopying information for users in the U.S.A. The Item-Fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copying, beyond that permitted by Section 107 or 108 of the United States Copyright Law, is paid. The appropriate remittance of \$3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 27 Congress Street, Salem, MA 01970.

Permission for other use. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific written permission must be obtained from the publisher for such copying.

Disclaimer. Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appears in this journal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

©TM The text paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

The Item-Fee Code for this publication is: 0026-2714/91 \$3.00 + .00

VOLUME CONTENTS

VOLUME 31, NUMBER 1

1991

PAGES 1-212

R. Gupta and R. Goel	1 Profit analysis of a two-unit cold standby system with abnormal weather condition
R. Gupta, R. Goel and L. R. Goel	7 Profit analysis of a two multi-component unit standby system with MRT
L. R. Goel, R. K. Agnihotri and R. Gupta	11 Two-unit redundant system with inspection and adjustable rates
A. A. Chari, M. P. Sastry and S. Madhusudana Verma	15 Reliability analysis in the presence of chance common cause shock failures
M. Pandey and Md. Borhan Uddin	21 Estimation of reliability in multi-component stress-strength model following a Burr distribution
A. Srivastava	27 Current transport mechanism of polysilicon-emitter transistor
Z. D. Prijić, S. S. Dimitrijev and N. D. Stojadinović	33 Analysis of temperature dependence of CMOS transistors' threshold voltage
P. K. Kapur and R. B. Garg	39 Optimum release policy for an inflection s-shaped software reliability growth model
N. L. Butani	43 Generalized availability measures for repairable systems with preparation time for repair
D. Kumar, J. Singh and P. C. Pandey	47 Behavioural analysis of a paper production system with different repair policies
S. A. Siddiqui and S. Kumar	53 Bayesian estimation of reliability function and hazard rate
M. N. Gopalan and N. Anantharaman	59 On the utilization analysis of a two-stage transfer line production system subject to inter-stage inspection and initial buffer
I. J. Józwiak	65 The influence of fault occurrence on multiaccess system throughput
I. J. Józwiak and J. Legut	71 Decision rule for an exponential reliability function
Yisong Dai	75 Optimal low-frequency noise criteria used as a reliability test for BJTs and experimental results
R. K. Tuteja, R. T. Arora and G. Taneja	79 Stochastic behaviour of a two-unit system with two types of repairman and subject to random inspection
V. Sridharan	85 A note on a multi-unit system with r repair facility
A. Ragab	91 Estimation and predictive density for the generalized logistic distribution
K. B. Kulasekera	97 Smooth nonparametric estimation of mean residual life
A. M. Abouammoh and M. A. Al-Kadi	109 On measures of importance for components in multistate coherent systems
Jiajun Shao and L. R. Lamberson	123 Markov model for k -out-of- n :G systems with built-in-test
M. A. Manzoul and M. Suliman	133 Fault-tolerant microprocessor-based overcurrent relays
M. Suliman and M. A. Manzoul	141 Neural network realization of Markov reliability and fault-tolerance models
R. C. Tiwari and C. Kimmel	149 Nonparametric Bayes estimation of the survival function and failure rate from record-breaking data
M. A. Styblinski	159 Formulation of the drift reliability optimization problem

- T. Yanagisawa** 173 Test of amorphous silicon solar cells: characteristics degradation due to exposure to intermittent light at several constant ambient temperatures and the validity of the test method
- L. B. Page and J. E. Perry** 185 A note on computing environments and network reliability
- H. Reiche** 187 Society of Reliability Engineers Bulletin
- 189 Book Reviews
VLSI Reliability
Particles on Surfaces 2. Detection, Adhesion, and Removal
Microprocessor Interfacing
- 193 Calendar of International Conferences, Symposia, Lectures and Meetings of Interest
- 197 Publications, Notices, Calls for Papers, etc.
- 199 World Abstracts on Microelectronics and Reliability
- i New Patents

VOLUME 31, NUMBER 2/3	1991	PAGES 213-558
L. R. Goel and S. C. Sharma	213	Stochastic analysis of a two-unit deteriorating standby system with two switching devices
L. R. Goel, R. Gupta and P. K. Tyagi	219	CHE failure in a two-unit standby system with slow switch, repair and post repair
M. N. Gopalan and N. N. Murulidhar	223	Cost analysis of a one-unit repairable system subject to on-line preventive maintenance and/or repair
V. O. Roda and O. Trindade, Jr	229	On the effect of power-line disturbances on microcomputer performance
M. R. Bastos Martini and J. Moreira de Souza	237	Reliability assessment of computer systems design
D. M. Brkić	245	A method for evaluation of number class intervals of histogram
E. Zanoni, P. Pavan, G. Spiazzini, B. Bonati and C. Canali	249	Analysis of d.c. and a.c. anomalous latch-up effects in commercial CMOS integrated circuits
Hong-zhou Wang and Bao-Hua Ma	255	A practical method of binomial reliability assessment
I. P. Singh and Chhotu Ram	257	Three-server bulk service queue with service interruptions and exponential repairs
I. P. Singh	261	Pre-emptive repeat priority repairs and failure of non-failed component during system failure of a complex system
S. Madhusudana Verma and A. A. Chari	265	Availability and frequency of failures of a system in the presence of chance common-cause shock failures
Sheng Feng and Y. K. Malaiya	271	Optimization of test parallelism with limited hardware overhead
A. Kumar and S. C. Garg	277	Reliability analysis of a system with a human operator and subject to two failure modes
K. B. Misra	285	An algorithm to solve integer programming problems: an efficient tool for reliability design
K. B. Misra and U. Sharma	295	Applications of a search algorithm to reliability design problems
K. B. Misra and U. Sharma	303	An efficient approach for multiple criteria redundancy optimization problems
K. B. Misra and U. Sharma	323	Multicriteria optimization for combined reliability and redundancy allocation in systems employing mixed redundancies

U. Sharma, K. B. Misra and A. K. Bhattacharji	337 Application of an efficient search technique for optimal design of a computer communication network
O. Martynenko	343 Repair body cost minimization with unreliable Markovian restoration
B. K. Jones and Y. Z. Xu	351 Excess noise as an indicator of digital integrated circuit reliability
Who Kee Chung	363 Reliability analysis of a series system with repair
Who Kee Chung	367 Reliability analysis of a human operator under several levels of stress
Who Kee Chung	371 Reliability analysis of a series repairable system with multiple failures
C. A. Goben, M. Suliman and M. A. Manzoul	375 TMR neural simulation
V. Makiš and A. K. S. Jardine	381 Optimal replacement of a system with imperfect repair
X. Gui, M. Z. Wang and G. B. Gao	389 Monte Carlo simulation for improving electromigration lifetime by balancing temperature and structural gradients
Zhibang Zhou and Chunxin Yuan	401 Reliability measures for fail safe computer-based systems
A. A. Ismaeel	407 A stuck fault model for dynamic CMOS combinational circuits
B. S. Dhillon and H. C. Viswanath	429 Reliability analysis of a non-identical unit parallel system with common-cause failures
Jiajun Shao and L. R. Lamberson	443 Reliability model of cold standby systems with built-in-test
R. Gupta and S. Bansal	453 Analysis of a complex system composed of two sub-systems with their standbys
Y. S. Sherif and R. G. Dear	465 The Sherif-Dear simple (SDS) theorem in number theory
M. Alidrisi, S. Abed, O. Ozkul, S. El-Assouli, M. Amer and A. Saber	473 Regression models for estimating survival of patients with non-Hodgkin's lymphoma
A. Noore, H. Nariman and M. A. Manzoul	481 Design of reconfigurable fault-tolerant VLSI/WSI processor array structures
L. Anneberg and E. Yaprak	491 Local area network implementation of Petri net reachability analysis
Jeng Yann-Chyn, Huang Ming-Fon and Li Chang-Chung	501 Optimizing the thermalsonic bonding process for thick film hybrid IC by the Taguchi Method
A. Rageb	511 On multivariate generalized logistic distribution
J. R. Green and A. S. Ragab	521 Revised test that a distribution is new better than used
D. Badenius	525 New definitions of basic R&M terms
A. Dziedzic	537 Physicochemical investigations and nonstandard electrical measurements of inks and thick films—bibliography
A. Dziedzic	549 Bibliography on electrical conduction in thick film resistors i New Patents

VOLUME 31, NUMBER 4

1991

PAGES 559-816

PETRI NETS AND RELATED GRAPH MODELS

T. Murata	559 Foreword
G. S. Hura	561 Preface
W. Seiche	563 Control synthesis based on a graph-theoretical Petri net analysis

- R. Stansifer and D. Marinescu** 577 Petri net models of concurrent Ada programs
- K. Johansson** 595 Modelling solutions for agreement problems with PrT-nets
- R. M. Shapiro** 607 Validation of a VLSI chip using hierarchical colored Petri nets
- W. M. Zuberek** 627 Timed Petri nets definitions, properties, and applications
- Shao-Wei Leu, E. B. Fernandez and T. Khoshgoftaar** 645 Fault-tolerant software reliability modeling using Petri nets
- G. Florin, C. Fraize and S. Natkin** 669 Stochastic Petri nets: properties, applications and tools
- M. Ajmone Marsan, G. Balbo, G. Chiola, G. Conte, S. Donatelli and G. Franceschinis** 699 An introduction to generalized stochastic Petri nets
- T. Murata, R. S. Bhatia and S. M. Shatz** 727 Markov chain reduction and analysis of GSPN models for task allocation in distributed systems
- Chuang Lin and D. C. Marinescu** 747 On the analysis of stochastic high level Petri net models
- Po-Zung Chen, S. C. Brueell and G. Balbo** 769 Formulating and solving optimization problems using stochastic timed Petri nets
- F. S. Etessami and G. S. Hura** 793 Knowledge net shell (KNS): Petri net based development tool for expert systems
- 813 Calendar of International Conferences, Symposia, Lectures and Meetings of Interest

i New Patents

VOLUME 31, NUMBER 5	1991	PAGES 817-1062
Su Chen, Daorong Xu and Shibai Tong	817	A new algorithm for minimal disjoint sum of products
P. C. Tewari, I. P. Singh and M. K. Khare	823	Reliability analysis of a conveyor belt system, with only one server, subject to failures and idleness after repair
L. R. Goel and P. Srivastava	827	Profit analysis of a two-unit redundant system with provision for rest and correlated failures and repairs
L. R. Goel and P. Srivastava	835	A two-unit cold standby system with three modes and correlated failures and repairs
L. R. Goel, R. K. Agnihotri and Rakesh Gupta	841	A single-server two-unit warm standby system with n failure modes, fault detection and inspection
Jai Singh and B. Dayal	847	A 1-out-of- N : G system with common-cause failures and critical human errors
Dinesh Kumar, P. C. Pandey and Jai Singh	851	Behaviour analysis of a urea decomposition system in the fertilizer industry under general repair policy
Dinesh Kumar, P. C. Pandey and Jai Singh	855	Process design for a crystallization system in the urea fertilizer industry
R. Nadarajan and D. Jayaraman	861	Series queue with general bulk service, random breakdown and vacation
P. P. Gupta, Anju Singhal and S. P. Singh	865	Cost analysis of a multi-component parallel redundant complex system with overloading effect and waiting under critical human error
F. Beichelt and P. Tittmann	869	Reliability analysis of communication networks by decomposition
G. Matthäi	873	A model for mechanisms in plastic-encapsulated microelectronic devices during temperature-humidity tests—II
S. M. Joshi and K. B. Misra	879	Quantitative analysis of software quality during the "design and implementation" phase

V. Ramachandran and V. Sankaranarayanan	885 Fuzzy measure of complex system outages
V. M. Cătuneanu, C. Moldovan, Fl. Popențiu and D. Popovici	889 Optimal learning time for human operators
V. M. Cătuneanu, C. Moldovan, Fl. Popențiu and D. Popovici	895 Software reliability release policy with testing effort
V. M. Cătuneanu, A. Mihalache, Fl. Popențiu and D. Popovici	901 Optimization of software testing time with debugging improvement
T. I. Sultan	907 A model for productivity measurement in the electronics industry
C. A. Ntuen and M. Chikha	913 A consideration of reliability in economic distribution quantity for a warehouse
C. A. Ntuen and M. Chikha	919 Reliability analysis of warehouse containers under life test policies
C. A. Ntuen	927 Minimax review schedules for degradable systems under a specified operational reliability
Qun Jin, Y. Sugasawa and K. Seya	933 Analysis of stochastic Petri net model with non-exponential distributions using a generalized Markov renewal process
H. M. Barakat and E. M. Nigm	941 Weak limits of random quasi-ranges and random quasi-half-ranges
Kang W. Lee and Jung S. Hong	955 Reliability evaluation of a phased mission system with time varying redundancy and failure probability
A. Bobbio	963 Architectural factors influencing the reliability of fault-tolerant VLSI arrays
H. S. Hajghassem, J. R. Yeargan, W. D. Brown and J. G. Williams	969 Modelling the effects of neutron radiation on the Gummel-Poon parameters for bipolar NPN transistors
A. A. Gagin and O. V. Klimovsky	985 A method for computing steady-state reliability indexes of a network with limited repair
M. O. Abou-El-Ata	1001 The state-dependent queue: M/M/1/N with reneging and general balk functions
Shey-Huei Sheu	1009 A general age replacement model with minimal repair and general random repair cost
Shey-Huei Sheu	1019 Periodic replacement with minimal repair at failure and general random repair cost for a multi-unit system
	1027 Society of Reliability Engineers Bulletin
	1029 Book Reviews <i>Computer Networks and Systems: Queueing Theory and Performance Evaluation</i> <i>Practical Reliability Engineering</i> <i>Boolean Functions with Engineering Applications and Computer Programs</i>
	1033 Publications, Notices, Calls for Papers, etc.
	1037 World Abstracts on Microelectronics and Reliability
	1057 New Patents

VOLUME 31, NUMBER 6

J. M. Kontoleon and A. Stergiou

K. K. Sharma

1991

PAGES 1063-1298

- | |
|--|
| 1063 Reliability analysis and design of a fault-tolerant random access memory system |
| 1069 Improved bounds for the reliability of a system |

K. K. Sharma and R. S. Rana	1073 Robustness of sequential gamma life-testing procedures in respect of expected failure times
K. K. Sharma	1077 Corrected bounds for reliability when strength and stress distributions are known
M. N. Gopalan and N. Anantharaman	1081 Stochastic analysis of machine interference for a production system with two non-identical machines
M. N. Gopalan and S. S. Waghmare	1085 Cost-benefit analysis of single-server n -unit imperfect switch system with adjustable repair
D. Trstenský and L. Schwartz	1089 Reliability of local area networks with bus and ring topologies
P. R. Deshmukh and W. S. Khokle	1091 Effect of time-dependent development process on the limit of proximity exposure compensation in electron beam lithography
A. Bhattacharya and A. K. Bhattacharji	1097 Redundancy optimization problems for systems with dependent failure rates
B. V. S. Sisodia and S. N. Rai	1101 On estimation procedures of variance subsequent to preliminary test of significance
S. E. Moafi B., L. R. Goel and Rakesh Gupta	1105 Comparison of two stochastic models for two-unit series system with cold standbys
L. R. Goel, V. S. Rana and Rakesh Gupta	1113 Stochastic analysis of a computer system model with intelligent terminals and two types of failure
R. P. Anjard Sr	1119 Paradigms of quality for microelectronics and SMT
R. P. Anjard Sr, D. Hagerty, G. K. Griffith, Shin-Ta Liu, E. M. Mustonen and D. A. Pasfield	1123 Cpk applications—uses and abuses
R. P. Anjard Sr	1127 Microelectronics' and reliability's new tool: UNIX today
N. Boychinova, V. Filev and O. Mirchev	1133 Some aspects of IC reliability estimation through accelerated life tests
Qun Wang	1137 A modification of Bayesian approach in nuclear plant data analysis
A. H. Rawicz	1143 Incandescent sign lamps and a very rough bath-tub curve
Byung-Ho Jo and Hee-Yeung Hwang	1153 Output probability from a general combinational network
S. W. Labib	1163 Stochastic analysis of a two unit warm standby system with two switching devices
J. R. Green and A. S. Ragab	1175 Testing that a distribution is new better than used of age t_0
A. Ragab, J. R. Green and M. C. K. Tweedie	1181 The Burr Type II distribution: properties, order statistics
A. K. Hosni	1193 Mean integrated square error of a recursive estimator of a distribution function
R. O. Al-Seedy	1203 The truncated queue M/M/2/k with both balking and an additional server for longer queues
E. Petrova and N. Malevris	1211 Rules and criteria for when to stop testing a piece of software
L. R. Jaisingh	1229 Bayesian estimation under exponential failure distribution
R. K. Ulrich, A. J. Phillips, D. H. Yi, W. D. Brown and S. S. Ang	1237 Mechanical stability of PECVD silicon nitride protective films over bondwires, bonds and bondpads during thermal stress
Who Kee Chung	1251 Reliability evaluation of a human operator under various levels of stress
M. Suliman	1257 Safety-modelling on neural networks

- M. Suliman and C. A. Goben** 1269 Neural realization of TMR with coverage
- Vinita Misra, V. V. Rao and
K. L. Chopra**
- H. Reiche**
- 1279 *Technical Note*
Annealing effects on transition temperature of r.f. sputtered
Bi-Sr-Ca-Cu-O thin films
- 1283 Society of Reliability Engineers Bulletin
- 1285 Book Review
An Elementary Guide to Reliability. 4th Edition
- 1287 Calendar of International Conferences, Symposia, Lectures and
Meetings of Interest
- 1291 Publications, Notices, Calls for Papers, etc.
- 1295 New Patents

i Title Section, Volume Contents and Author Index, Volume 31, 1991